**IN THE SPECIFICATION**

Pages 1 and 2, the paragraph bridging these pages from page 1, line 20 to page 2, line 8, replace the bridging paragraph with:

A resolution R on a semiconductor wafer in the projective exposure method is generally shown by $R=k\times\lambda/NA$, where k denotes a constant depending on a resist material or a process, $\lambda$ denotes a wavelength of illumination light, NA denotes a numerical aperture of a projective exposure lens. As seen by the above relational equation, a projective exposure technique using a light source with a shorter wavelength is required as ~~a pattern is further fined~~ patterns are made more fine. At present, an LSI is manufactured by a projective exposure system using g-line ($\lambda$=438nm) or i-line ($\lambda$=365nm) of a mercury lamp, or a KrF excimer laser beam ($\lambda$=248nm) as a light source. For the purpose of achieving a finer pattern, it is studied to use an ArF excimer laser beam ($\lambda$=193nm) or $F_2$ excimer laser beam ($\lambda$=157nm) having a shorter wavelength.

A1

Pages 2 and 3, the paragraph bridging these pages from page 2, line 21 to page 3, line 4, replace the bridging paragraph with:

A2

Meanwhile, for example, Japanese Patent Laid-Open No. 5-289307 discloses a photomask using not chromium but a photoresist as a shading film. This is a mask using the fact that a photoresist has a shading characteristic relative to short wavelength rays such as ArF rays or the like. Because this technique makes it possible to fabricate a photomask without including a step of etching chromium, an effect of reducing the mask cost can be expected. Moreover, because ~~including~~ there is no step of etching chromium, this technique has an advantage in that a pattern dimension accuracy can be ensured.

Page 4, the first full paragraph, lines 4 to 11, replace the paragraph with:

A3

As a finer pattern is achieved, such problems have become more ~~remarkably that~~ important because the working accuracy of a mask pattern becomes ~~severer~~ more stringent and the photomask manufacturing cost is increased due to increase of amounts of pattern data. In general, to manufacture one kind of semiconductor integrated circuit device, increase in the

A3 cont photomask manufacturing cost ~~comes to~~ becomes a very large problem because about 20 to 40 photomasks are used, for example.

Page 4, the second full paragraph, lines 12 to 22, replace the paragraph with:

A4 Under the above situation, however, it is necessary to ~~further fine~~ make a circuit pattern more fine at present in order to improve a semiconductor device in integration degree and in operation speed, and thereby technical development is progressed so as to shorten the wavelength of exposure light. However, if the wavelength of exposure light is shortened, then a material of the lens is a rare and expensive material such as $CaF_2$~~,~~ and illumination damage of an optical member increases, and thereby component life is shortened. Therefore, short-wavelength exposure light becomes expensive.

Page 8, the first full paragraph, lines 17 to 24, replace the paragraph with:

A5 Moreover, the above binder is used to connect the above nanoparticles to each other to form a film, and a polymeric ~~materials~~ material or organic ~~compounds are~~ compound is generally used as the binder. When the photomask according to

the present invention is formed, the shade pattern is formed by active radiation. Therefore, the binder utilized in the present invention is one that has any photosensitivity to radiation, namely, that is desirably made of a resist material.

A5 cont.

Pages 8 and 9, the paragraph bridging these pages from page 8, line 25 to page 9, line 16, replace the bridging paragraph with:

A6

Furthermore, the form of the photomask according to the present invention can be applied to all transmission types of photomasks such as a binary mask, half-tone phase-shift mask, Levenson phase-shift mask and the like which are used in a photolithography step. The photomask of the present invention can be used together with such a photomask structure as to use a metallic film such as a chromium film or the like as a shade band in one photomask. That is, it is also possible to use a structure having both a shade pattern formed by a metallic film and the above shade pattern of the present invention in the integrated-circuit-pattern area of one photomask. Thereby, only a predetermined portion on a photomask can be freely changed to a certain extent in a short time. That is, in the case of changing a portion of the photomask, only the

A6 cont.

portion to be changed can be changed, instead of reforming the entire ~~of the~~ photomask from the beginning. Therefore, it is possible to easily reproduce or change the photomask in a short time.

Page 10, the first full paragraph, lines 6 to 24, replace the paragraph with:

A7

According to a technique studied by the present inventors, the technique is one that an organic material used as a resist material is formed on a glass plate of a photomask as a shade band, and that transmission of the light illuminated on the glass plate is prevented due to absorption of organic molecules at the shade band. This absorption is a specific absorption depending on the chemical structure of a material, and the wavelength of the absorption has a distribution to a certain extent, but is a specific wavelength. In this case, the light energy absorbed by the organic molecules excites ~~he~~ the organic molecules. Then, some of the energy changes to heat or fluorescence or phosphorescence from an excited state and is discharged to the outside. However, remaining energy excites the organic molecules and cuts chemical bonds between the organic molecules or reacts with other chemical bonds. Therefore, as

A7 cont.

light is illuminated, the resist material serving as a shade band deteriorates, and finally loses the function as a shade.

Page 13, the first full paragraph, lines 5 to 25, replace the paragraph with:

A8

The shade pattern of the photomask according to the present invention may include dye molecules which absorb the light in addition to nanoparticles as components for transmitting no light. In this case, it is possible to reduce the quantity of nanoparticles to be contained, and thereby to obtain a high resolution. However, in the case where contribution of dye is large or only dye is simply contained as a material for shading light, light energy is absorbed by dye molecules and may cause both excitation of the molecules and any chemical reaction, and thereby absorbance may change. However, in the present invention, because the above nanoparticles are used together with others, such drawbacks can be difficult to cause or are not caused. That is, the present invention is greatly different, in configuration, from a photomask having a pattern with a shading characteristic obtained by merely making a resist film which contains light dye, and can improve ~~better~~ the light-resistant characteristic better than the case of adding only the dye. Therefore, it is

A8 cont. possible to improve the service life of the photomask.

Page 18, the second full paragraph, lines 16 to 23, replace the paragraph with:

A9

Furthermore, in the case where the photomask of the present invention is a Levenson phase-shift mask having a phase shifter, the phase shifter can be obtained by forming ~~an~~ a coated-glass SOG (Spin On Glass) film at a predetermined position located on a glass plate so as to have a predetermined film thickness. Moreover, the phase shifter may be obtained by making concavity in a glass plate at a predetermined position up to a predetermined depth.

Pages 20 and 21, the paragraph bridging these pages from page 20, line 22 to page 21, line 5, replace the bridging paragraph with:

A10

Moreover, in the case of forming a phase shifter by coated glass having no photosensitivity, the phase shifter is formed by the steps of: forming ~~an~~ a coated-glass film on a mask basic substance; coating a resist onto the coated-glass film; exposing and developing the resist to form a resist pattern; etching the coated-glass film by using the resist pattern as a mask; removing the resist pattern to form a

A10 cont. phase-shifter pattern, forming, on the phase-shifter pattern, a film containing at least nanoparticles and a binder; and exposing and developing the film to form a shade pattern.

Page 28, the first full paragraph, lines 2 to 17, replace the paragraph with:

A11 In the case of a pattern forming method of the present invention, it is preferable that wavelength of the light used to expose a photo-reactive composition film on a wafer is 100 nm or more and 700 nm less. In the case of using ~~an~~ a larger exposure-light wavelength, for example, it is possible to use a high-pressure mercury-vapor lamp as a light source, and so realize a low cost because a light source or an exposure system is comparatively inexpensive. However, because a resolution relates to a wavelength, the resolution is not improved if an exposure wavelength is a large wavelength. In contrast, in an exposure system using, as a exposure light, a small wavelength such as an ArF or KrF excimer laser beams or the like, the price thereof is high in the existing circumstances but the resolution is further improved for reduction in the wavelength and a fine pattern can be formed.

Pages 33 and 34, the paragraph bridging these pages from page 33, line 23 to page 34, line 4, replace the bridging paragraph with:

The following embodiments will be described by dividing advantageously a plurality of sections or a plurality of sub-embodiments ~~in case of advantageous need~~, ~~but~~ noting that, except ~~the case of being~~ where especially described, the subdivisions have something to do with each other. Further, one among the plurality of sections or sub-embodiments has something to do with a part or ~~the entire~~ all of the others, or ~~the entire~~ all of the modifications thereof, or detailed or supplementary explanations, or the like.

A12

Page 34, the first full paragraph, lines 5 to 13, replace the paragraph with:

Moreover, in the case of the following embodiments, when the number of factors (including the number of pieces, value, quantity, range, and the like) is described, the number of factors is not restricted to the specified number and is allowed that the number of factors may be the specified number or more or less, except ~~the case of being~~ where particularly specified or ~~except the case~~ where the number of factors is theoretically clearly restricted to the specific number and

A13

A13 cont.

the like.

Page 34, the second full paragraph, lines 14 to 19, replace the paragraph with:

A14

Moreover, in the case of the following embodiments, it is needless to say that components (including elementary steps and the like) thereof are not always essential, except ~~the case of being~~ where particularly specified or ~~except the case~~ where the components are thought to be theoretically and clearly essential, and the like.

Page 34, the third full paragraph, lines 20 to 27, replace the paragraph with:

A15

Similarly, in the case of the following embodiments, when shapes or positional relations of components are described, shapes substantially approximating to or similar to respective original shapes are included except ~~the case of being~~ where particularly specified, or ~~except the case~~ where the shapes are not thought to be theoretically and clearly approximating to or similar to the original shapes. These are also the same as the above-mentioned values and ranges.

Page 35, the second full paragraph, lines 5 to 10, replace the paragraph with:

A16

Furthermore, in the case of the present embodiments, an MIS·FET (Metal Insulator Semiconductor Field Effect Transistor) which is an example ~~one~~ of a field effect ~~transistors~~ transistor will be abbreviated as an MIS, ~~and~~ a p-channel MIS·FET will be abbreviated as a pMIS, and an n-channel MIS·FET will be abbreviated as an nMIS.

Page 35, the fourth full paragraph, lines 16 to 20, replace the paragraph with:

A17

The embodiments will be described below in detail by referring to the accompanying drawings. Before describing the embodiments, preparation of a resist material containing at least nanoparticles and a binder will be ~~describe~~ described below.

Pages 38 and 39, the paragraph bridging these pages from page 38, line 24 to page 39, line 7, replace the bridging paragraph with:

A18

Moreover, conventional illumination or oblique illumination may be used as illumination utilized at the exposure. The conventional illumination means normal

illumination whose light-intensity distribution is comparatively ~~uniformity~~ uniform. Moreover, the oblique illumination is illumination whose central illuminance is lowered and includes multi-pole illumination such as off-axis illumination, annular illumination, quadra-pole illumination, penta-pole illumination or the like, or a resolution enhancement technique using a pupil filter equivalent to the multi-pole illumination.

A18 cont.

Page 40, the first full paragraph, lines 2 to 10, replace the paragraph with:

In this case, the above shade pattern 2 has not been formed at a portion of the mask M1 with which the pellicle frame 9a, the reticle stage 10, and a reticle carrying system (not illustrated) are in contact. This is because if the shade pattern 2 is formed on the contact point, the shade pattern 2 is removed therefrom at the time of contact and ~~comes~~ becomes subject to foreign matter defect. This is also the reason for avoiding such a problem that the pellicle frame 9a is removed therefrom.

A19

Pages 45 and 46, the paragraph bridging these pages from page 46, line 24 to page 46, line 8, replace the bridging paragraph with:

The mask of this embodiment can be manufactured by applying, exposing, and developing an organic film and the mask manufacturing yield is also high because there ~~are~~ is no sputtering step using a vacuum system when a metallic film made of chromium (Cr) or the like is attached widely and no step of etching the metallic film is ~~not~~ included. Moreover, in the case of using carbon black as nanoparticles similarly to this embodiment after use of a mask, it is possible to completely reproduce the carbon black in a state of blanks by ashing or solvent treatment. Therefore, the above mentioned embodiment is effective from viewpoints of resource recycling and cost reduction.

A20

Page 48, the first full paragraph, lines 1 to 9, replace the paragraph with:

Thus, in the case of this embodiment, it is possible to increase a range of the wavelength of exposure light usable for the mask M. Therefore, it is possible to select an exposure system meeting a technical condition and an economic condition and to perform exposure treatment when various

A21

A21 cont.

patterns of a semiconductor device ~~is~~ are exposed. Therefore, it is possible to improve performances of a semiconductor device and to reduce the cost of the semiconductor device.

Pages 51 and 52, the paragraph bridging these pages from page 51, line 25 to page 52, line 8, replace the bridging paragraph with:

A22

In the case of the present embodiment, a positive shade pattern 2 having a film thickness of 0.70 μm and a minimum dimension of 1.2 μm is formed by using the resist (IV) in which aluminum oxide is dispersed and which is prepared in the preparation example 4, instead of the resist (I) in which carbon is dispersed and which is used for the first embodiment, thereby forming a film on a ~~quart~~ quartz plate 1, exposing the film by an electron-beam exposure system, and then baking and spray-developing the film after exposure, as shown in FIGs. 1, 2A, 2B, 3A, 3B and 3C, similarly to the first embodiment.

Pages 55 and 56, the paragraph bridging these pages from page 55, line 9 to page 56, line 14, replace the bridging paragraph with:

A23

Moreover, to improve durability thereof, the shifter film

13 is widely attached and then is heat-treated. The film thickness d is a value after the above heat treatment. In this case, for example, baking is performed for 30 minutes at 200°C as heat treatment, but the heat treatment is not restricted to the above baking. Furthermore, because the film thickness is important to decide a phase angle, it is measured after performing the heat treatment and forming the film, and when the film thickness is not kept within a range of a reference value, the film is removed and then a new film is formed again. Though an allowable value of film thickness deviation depends on a dimension or necessary dimensional accuracy, it is generally about 1%. High resolution and dimensional accuracy are easily obtained because the shifter film 13 is widely attached on flatness thereof, and thereby the film-thickness uniformity is easily obtained, and there does not arise a problem of change in a phase angle (film thickness) per dimension due to the loading effect at the time of etching. In this case, a sputtering method is used to form the shifter film. However, it is also possible to use a CVD (Chemical Vapor Deposition) method or ~~a~~ an application forming method. Particularly, the application forming method has such a feature that a high uniformity of film thickness is obtained. In this case, for example, it is possible to form a

A23 cont.

film with a uniformity of 0.2%. The value of 0.2% has a high accuracy corresponding to about 0.1° in terms of a phase angle deviation. Moreover, when a film defect (pinhole defect or foreign matter defect) is detected on a phase shifter film, the film is reproduced and reformed. Thus, process control is simplified because measures can be taken for a phase defect at an initial stage thereof.

A23 cont.

Page 56, the first full paragraph, lines 15 to 27, replace the paragraph with:

A24

Then, as shown in FIG. 5B, an electron-beam resist 14 is applied onto the shifter film 13 to expose a desired shifter writing pattern. When the shifter film 13 is not a conductive film, a water-soluble conductive film is formed on the electron-beam resist 14 to take measures for charge-up thereof. When the above measures are not taken, a position deviation of the written pattern is caused. In the case of this embodiment, the writing-position deviation ~~duet~~ due to charge-up thereof does not occur because a conductive film is previously formed. As a result of examining a conductivity necessary to prevent the charge-up, it is clarified that it is very effective to suppress a sheet resistivity of 50 MΩ/cm$^2$ or less.

Pages 57 and 58, the paragraph bridging these pages from page 57, line 26 to page 58, line 16, replace the bridging paragraph with:

In this case, because the outer periphery of the shifter film 13 is tapered, a covering characteristic of the resist film 2R is improved and the dimensional accuracy of the shade pattern 2 is high because a film thickness deviation is comparatively small. Though there is not any pattern directly crossing a step, this tapering process is very effective because the film thickness deviation ~~includes~~ inclusive of the resist affects a wide range. In this case, a taper angle relative to the plate 1 is set to 60°. However, by setting the taper angle at a value smaller than 60° to make the taper portions ~~a~~ gentle ~~slope~~, it is possible to decrease the film thickness deviation. However, because it is necessary to form a shade pattern so as to cover the tapered portion by providing an adjustment play, the minimum shade-pattern width is restricted. An optimum taper angle is decided in accordance with a pattern minimum rule and a shifter and the offset of the adjustment accuracy of the shade pattern.

A25

Pages 59 and 60, the paragraph bridging these pages from page 59, line 14 to page 60, line 2, replace the bridging paragraph with:

The phase shift mask according to this embodiment has a very high controllability whose ~~a~~ phase error is kept within a range of 0.5° or less and has no dimensional dependency. Therefore, it is possible to improve the dimensional accuracy and resolution when a pattern is transferred. Moreover, since the shade pattern 2 contacts with the blanks and the phase shifter at a large area thereof, a defect such as pattern removal of the like does not occur either. Furthermore, the number of manufacturing steps is small in comparison with a normal mask manufacturing method using only a metallic film as a shade band, and therefore the yield thereof is also high and the TAT thereof is also short. Moreover, the TAT can be almost halved and the yield can be greatly improved from 30%, which is obtained by the above normal mask manufacturing method, to 90%.

A26

Pages 60 and 61, the paragraph bridging these pages from page 60, line 6 to page 61, line 13, replace the bridging paragraph with:

First, as shown in FIG. 6A, a photo-reactive shifter film

A27

15 is formed on a quartz plate (blanks) 1 similar to the above described. The photo-reactive shifter film 15 uses a material, for example, obtained by adding a photoacid generator to organic SOG (Spin On Glass). The photoacid generator uses TPS (triphenyl sulfonium trifluorate), but is not restricted to this TPS. Moreover, the photo-reactive shifter film 15 too is not restricted to organic SOG, and may use such a material to be transparent for exposure light, and have illumination-resistant characteristic relative to the exposure light, and ~~have~~ a photo-reactive characteristic at the time of mask-writing. The refractive index of the photo-reactive shifter film 15 used above relative to exposure light (with a wavelength of 193 nm) is 1.58, and the 1.58 refractive index is not greatly different from the 1.56 refractive index, which the quartz plate 1 has. Therefore, it is possible to reduce multiple interference thereof and to obtain an effect on a dimensional accuracy. Moreover, forming a conductive film on the quartz plate 1 is effective in prevention of charge-up thereof when writing of the photo-reactive shifter film 15 is subsequently performed, similarly to the sixth embodiment. In this case, formation of the photo-reactive shifter film 15 is performed by application, but may be performed by using other method such as an optical CVD method

A27 cont.

or the like. An application forming method has such a superior feature as to be simple and cause ~~a less number of~~ fewer defects. After the photo-reactive shifter film 15 is applied, heat treatment is performed, for example, at 120°C. After the film is formed, a defect inspection is performed and thereby it is confirmed that a pinhole defect or a foreign matter defect is or not present. If any one of these defects is present, the photo-reactive shifter film 15 is removed and a new photo-reactive shifter film is reformed.

A27 cont.

Pages 62 and 63, the paragraph bridging these pages from page 62, line 5 to page 63, line 16, replace the bridging paragraph with:

Then, as shown in FIG. 6C, a shifter pattern 15a is formed by performing development. Then, the shifter pattern 15a is heat-treated in order to improve an exposure-light illumination-resistant characteristic and prevent weathering thereof. As the above heat treatment, for example, baking is performed for 30 minutes at 250°C, but the heat treatment is not restricted to baking. The resistance is further improved as the temperature rises. Moreover, because the film thickness of the shifter pattern 15a is important to decide a phase angle, the film thickness thereof is measured after the

A28

shifter pattern 15a is heat-treated and if the film thickness is not kept within a range of a reference value, the shifter pattern 15a is removed and a new pattern is reformed. An allowable value of the film thickness deviation is influenced by a dimension and a necessary dimensional accuracy but is generally kept at about 1%. Because the shifter pattern 15a is flatly and widely attached thereto, the film-thickness uniformity is easily obtained. Since there arises no such ~~no~~ problem that a phase angle (film thickness) per dimension changes due to the loading effect at the time of etching, high resolution and dimensional accuracy can easily be obtained. Therefore, a phase-shifter cutout defect and a remaining defect are inspected by an edge detection method. Because the shade band does not surround the shifter pattern 15a, it is possible to inspect a shifter defect by the edge detection method and thereby to perform simply a defect inspection with high detection accuracy. Thus, it is possible to form a phase shifter pattern having no defect and superior in phase controllability, only through an applying step, baking step, exposing step, and developing step without using an etching step. Thus, in the case of this embodiment, because it is unnecessary to use a resist applying step and an etching step when the shifter pattern 15a is formed, it is possible to

A28 Cont.

A28 Cont.

shorten the mask manufacturing process in comparison with the sixth embodiment. Moreover, because the material cost, fuel cost, and equipment cost thereof can be reduced, it is possible to reduce the mask cost.

Page 64, the first full paragraph, lines 7 to 19, replace the paragraph with:

A29

As a result of measuring the OD value of the shade pattern 2 made of the resist (I) in which carbon is dispersed and formed so at to have a remaining film thickness of 400 nm, the same result as the case of the sixth embodiment can be obtained by using a KrF excimer laser beam or an ArF excimer laser beam. Therefore, even in the case of the seventh embodiment, it is clarified that the shade pattern 2 is proper as the shading portion of a Levenson phase-shift mask for KrF and ArF excimer-laser-beam exposures. Moreover, by using the resists in which nanoparticles are dispersed and which ~~is~~ are prepared in the preparation examples 3 and 4, it is also possible to form a Levenson phase-shift mask.

Pages 64 and 65, the paragraph bridging these pages from page 64, line 20 to page 65, line 15, replace the bridging paragraph with:

According to this embodiment, it is possible to obtain a mask having a phase-error accuracy similar to the case of the above sixth embodiment. Since the mask has no dimensional dependency, it is possible to obtain high dimensional accuracy and resolution at the time of transferring a pattern by an ArF exposure beam. Moreover, in this case, because the shade pattern 2 contacts with the shifter pattern 15a and the quartz plate 1 at a large area thereof, a defect such as pattern removal or the like does not occur. Furthermore, the number of mask manufacturing steps is ~~greatly~~ very small in comparison with the case of the above normal mask manufacturing method and the mask manufacturing steps comprise only an applying, baking, exposing, developing, and inspecting steps in which ~~a less number of~~ fewer defects ~~occurs~~ occur (because the etching step is excluded). Therefore, the yield thereof is high and the TAT is short, too. In the case of this embodiment, it is possible to reduce the TAT up to about 1/3 and improve the yield from 30%, which is obtained by the above normal mask manufacturing method, to 90%. Though this embodiment uses, for example, ArF exposure, it is confirmed that KrF exposure is also effective, by adjusting the film thickness of the shifter pattern 15a to the KrF exposure.

A30

Page 75, the first full paragraph, lines 10 to 24, replace the paragraph with:

In the case of custom-made LSI products, a mask debug is frequently executed mainly on the first wiring layer 32. ~~Speed~~ The speed of the TAT for supplying a mask to the first wiring layer 32 decides the product development force, and thereby the necessary number of masks required increases, too. Therefore, it is ~~eminent~~ eminently effective to apply the present invention to this process. Moreover, the minimum pattern dimension of the second wiring layer is, for example, 0.35 μm (a pattern pitch is, for example, 0.8 μm) whose ~~a~~ value is large enough in comparison with an exposure wavelength (0.248 μm). Therefore, the KrF-excimer-laser-beam mask M having the shade pattern 2 made of the resist in which carbon is dispersed and which is used in the first embodiment of the present invention is applied to the second wiring layer.

A31

Page 77, the first full paragraph, lines 11 to 18, replace the paragraph with:

The above explanation is mainly that the present invention ~~has been made by the present inventors~~ is applied to a semiconductor device manufacturing method which is an

A32

applicable field serving as the background thereof. However, the present invention is not restricted to this, and can be also applied, for example, to a method for manufacturing a liquid-crystal panel, a disk array, a magnetic disk head, or a micro-machine.

A32 cont.